

REMARKS

This Amendment After Final Rejection is submitted in response to the outstanding final Office Action, dated October 26, 2004, and is accompanied by a one-month extension of time and a Request for Continued Examination (RCE). Following a 5 Restriction Requirement, claims 19-36, 39 and 40 were previously withdrawn from consideration and are proposed to be cancelled herein, without prejudice. Claims 1-18, 37 and 38 are presently pending in the above-identified patent application. In this response, applicants proposes to amend the specification and claims 1-4, 8, 12-15, 37 and 38. No additional fee is due.

10 This amendment is submitted pursuant to 37 CFR §1.116 and should be entered. The Amendment places all of the pending claims, i.e., claims 1 through 28, in a form that is believed allowable, and, in any event, in a better form for appeal. It is believed that examination of the pending claims as amended, which are consistent with the previous record herein, will not place any substantial burden on the Examiner. In 15 any event, the filing of the RCE requires the entry of the present amendment.

In the Office Action, the Examiner required cancellation of the restricted claims under 37 CFR §144. The Examiner rejected claims 8, 10, 11, 15, 17, and 18 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regards as the invention. The 20 Examiner rejected claims 1-8, 10-15, 17 and 18 under 35 U.S.C. §102(e) as being anticipated by Mui (United States Patent Number 6, 690,739) and rejected claims 37 and 38 under 35 U.S.C. §103(a) as being unpatentable over Mui. The Examiner indicated that claims 9 and 16 would be allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims.

25 The present invention has been discussed in Applicants' prior response, incorporated by reference herein.

The Specification has been amended to ensure explicit support in the specification for the subject matter of, e.g., claim 10. The amendment to the specification is clearly supported by, e.g., the language of claim 10 itself. No new matter has been 30 introduced.

FORMAL ISSUES

Cancellation of Unelected Claims

Claims 19-36, 39 and 40 are proposed to be cancelled herein, without prejudice. Applicants expressly reserves his right to file a Divisional application for a 5 determination of the patentability of such claims.

Section 112 Rejections

Claims 8, 10, 11, 15, 17, and 18 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regards as the invention. Regarding claim 8, 10 the Examiner asserts that claims 8 and 15 are indefinite since they fail to further limit claim 1 (since it is not clear that the method actually uses any pipelining). The Examiner also asserts that claims 8 and 15 are indefinite, as it is unclear how the method can be pipelined before after the steps of selecting.

Claims 8 and 15 are amended herein to ensure that they distinctly claim 15 the inventive subject matter. In particular, claims 8 and 15 have been amended to require “the step of storing said precomputed branch metrics in one or more registers before or after performing said selecting step.”

Regarding claim 10, the Examiner asserts that the language “at least two-dimensional branch metrics” is incomprehensible since it is not clear whether the cited 20 language refers to – at least one two-dimensional branch metric – or -- at least two multi-dimensional branch metrics --. Applicants note that this language appears in a number of claims. In fact, this term appears in the claims approximately 12 times. *The frequent usage of this term in the claims is the primary reason why the short-hand notation “at least two-dimensional branch metrics” was adopted by Applicants in the first place.* 25 Applicants submit that any other expression of the terminology would become unnecessarily complex and only add to the potential confusion.

Applicants note that in accordance with common usage of hyphens, the 30 hyphen in the cited language means that the number two refers to the number of dimensions, not the number of branch metrics. In particular, the term “at least two-dimensional branch metrics” requires a metric for a signal component having a dimension of “at least two.” Contrary to the Examiner’s assertion, the term “at least two-

dimensional branch metrics" is not grammatically incorrect. In fact, in stating that the term "at least three two-dimensional branch metrics" would be "correct," the Examiner has incorrectly parsed the term.

Further, terms such as "three-dimensional" are commonly used to describe 5 entities with three dimensions. Here, Applicants have merely replaced the term "three," from "three-dimensional," with the term "at least two," which is appropriate in the context of the present invention.

It is well settled that the Patent Laws allow an inventor to be his own 10 lexicographer. "To ascertain the true meaning of disputed claim language, resort should be made to the claims at issue, the specification, and the prosecution history. Moreover, claims are construed as they would be by those skilled in the art." *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 228 U.S.P.Q. 90 (Fed. Cir. 1985).

In order to avoid any potential ambiguity, Applicants have amended the specification at page 21, line 14, to include an express definition of this term.

15 Thus, Applicants believe that claims 8, 10, 11, 15, 17, and 18 are definite and respectfully request that the section 112 rejections be withdrawn.

PRIOR ART REJECTIONS

Independent Claims 1, 12, 37 and 38

Independent claims 1 and 12 were rejected under 35 U.S.C. §102(e) as 20 being anticipated by Mui and claims 37 and 38 were rejected under 35 U.S.C. §103(a) as being unpatentable over Mui.

A. Mui Does Not Precompute Branch Metrics or ISI Estimates

Independent claims 1 and 37 require the "precomputation of branch 25 metrics based on said precomputed intersymbol interference estimates."

Independent claims 12 and 38 require "precomputing intersymbol interference estimates based on a combination of (i) speculative partial intersymbol interference estimates for a first postcursor tap of said channel impulse response, wherein said speculative intersymbol interference estimates are based on each possible value for a 30 data symbol, and (ii) a combination of partial intersymbol interference estimates for each subsequent postcursor tap of said channel impulse response, wherein at least one of said

partial intersymbol interference estimates for said subsequent postcursor taps is based on a first past decision from a corresponding state.”

In the Response to Arguments section, at page 4, the Examiner asserts that “Viterbi’s algorithm inherently requires a branch metric computation calculated prior to 5 determining a new path metric.”

As clear from the present specification, however, as well as the common usage of those of ordinary skill in the art, the term, “precomputing” means computing a particular value, such as a branch metric, during a current clock cycle that is required for a future clock cycle (and not computing one type of value, i.e., a branch metric, before 10 another type of value, i.e., a new path metric, as suggested by the Examiner). *Further, the “precomputation” of a value necessarily requires storing the value for use at a later clock cycle.*

The Examiner is invited to contrast the discussion in conjunction with FIG. 7A of the present specification of a typical reduced state sequence, with the 15 discussion in conjunction with FIG. 8 of an RSSE algorithm with one-step look-ahead (i.e., one step precomputation) in accordance with one embodiment of the present invention. The branch metric and ACS computations in FIG. 7A **must be** performed in one clock cycle, as the RSSE of FIG. 7 does not contain any pipeline registers. The pipeline registers 825 allow the branch metrics to be precomputed one clock cycle ahead 20 of time, and stored in the pipeline registers 825 to be used by the ACSU 830 during the subsequent clock cycle.

Thus, Mui does not disclose or suggest “precomputing” a value, i.e., computing the value, such as a branch metric, during a current clock cycle that is required for a future clock cycle. Further, since Mui does not contain registers, such as pipeline 25 registers, for storing a value for a future clock cycle, then it is not possible for Mui to “precompute” values, as the term is used in the present specification and claims, and understood by those of ordinary skill in the art. A claim must be given its ordinary and accustomed meaning, unless it appears that the inventor used them differently. See, e.g., Gentex Corp. v. Donnelly Corp., 69 F.3d 527, 36 USPQ2d 1667 (Fed. Cir. 1995).

30 The Examiner’s discussion on pages 4-5 of the Abstract of Mui only reinforces the distinction between the conventional approach of *computing* branch

metrics, as compared to the novel *precomputation* approach of the present invention. To summarize, Mui does not explicitly state that precomputation is performed, and a review of the architecture disclosed by Mui confirms that such precomputation is not even possible.

5 Thus, Mui does not disclose or suggest the “precomputation of branch metrics based on said precomputed intersymbol interference estimates,” as required by independent claims 1 and 37; or “precomputing intersymbol interference estimates based on a combination of (i) speculative partial intersymbol interference estimates for a first postcursor tap of said channel impulse response, wherein said speculative intersymbol interference estimates are based on each possible value for a data symbol, and (ii) a combination of partial intersymbol interference estimates for each subsequent postcursor tap of said channel impulse response, wherein at least one of said partial intersymbol interference estimates for said subsequent postcursor taps is based on a first past decision from a corresponding state,” as required by independent claims 12 and 38.

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B. Mui Does Not Select from Precomputed BMs or ISIs

In applicants’ prior response, Applicants asserted that Mui also does not disclose or suggest selecting a *precomputed* branch metric based on a second past decision from a corresponding state,” as required by independent claims 1 and 37.

20 Similarly, Mui does not disclose or suggest selecting a *precomputed* intersymbol interference estimate based on a second past decision from a corresponding state,” as required by independent claim 12 and 38.

25 In response, the Examiner asserts, at page 4, middle paragraph, that “Viterbi’s algorithm inherently requires branch metric calculations at nodes on a Trellis prior to updating state metrics for most likely paths and selecting a branch metrics to update state metrics for most likely paths based on previously calculated state metrics.” The Examiner never indicates or asserts that a selection is being performed from *precomputed* branch metrics {or ISI estimates}. Again, as previously indicated, Mui does not disclose or suggest “precomputing” a value, and thus, Mui cannot possibly be 30 said to select from among precomputed values.

Thus, Mui does not disclose or suggest “selecting one of said *precomputed*

branch metric based on a second past decision from a corresponding state,” as required by independent claims 1 and 37, or “selecting one of said *precomputed* ISI estimate based on a second past decision from a corresponding state,” as required by independent claims 12 and 38.

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C. Further Analysis of Examiner’s Responses

With regard to the Examiner’s assertion that the term “RSSE” appearing in the preamble is not given patentable weight, Applicants note that much of the functional features appearing in the *body* of each independent claim are directly associated with an RSSE technique, and provides further bases for distinguishing over Mui.

In response to the Examiner’s assertion that Applicants argued limitations are not in the claims, Applicants note that the scope of the invention is defined by the claims and Applicants may have paraphrased claim limitations that were not particularly relevant to the discussion.

D. Summary

To summarize, among other features not shown by Mui, Mui does not disclose or suggest:

a) “precomputation of branch metrics based on said precomputed intersymbol interference estimates,” as required by independent claims 1 and 37; or “precomputing intersymbol interference estimates based on a combination of (i) speculative partial intersymbol interference estimates for a first postcursor tap of said channel impulse response, wherein said speculative intersymbol interference estimates are based on each possible value for a data symbol, and (ii) a combination of partial intersymbol interference estimates for each subsequent postcursor tap of said channel impulse response, wherein at least one of said partial intersymbol interference estimates for said subsequent postcursor taps is based on a first past decision from a corresponding state,” as required by independent claims 12 and 38; or

b) “selecting one of said *precomputed* branch metric based on a second past decision from a corresponding state,” as required by independent claims 1 and 37, or

“selecting one of said *precomputed* ISI estimate based on a second past decision from a corresponding state,” as required by independent claims 12 and 38.

Dependent Claims 2-11 and 13-18

Dependent claims 2-8, 10, 11, 13-15, 17, and 18 were rejected under 35
5 U.S.C. §102(e) as being anticipated by Mui.

Claims 2-11 and claims 13-18 are dependent on claims 1 and 12, respectively, and are therefore patentably distinguished over Mui because of their dependency from independent claims 1 and 12 for the reasons set forth above, as well as other elements these claims add in combination to their base claim. The Examiner has
10 already indicated that claims 9 and 16 would be allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims.

In addition, with regard to claim 2, Mui (col. 6, lines 20-45) describes the output of a prior art decision-feedback equalizer, but not the computation of the templates $q(x,y)$ that are described in col. 25, lines 35-60. Templates $q(x,y)$ are not equal to partial
15 intersymbol interference estimates. Also, the output of a prior art decision-feedback equalizer is not equal to partial intersymbol interference estimates. Thus, Mui does not disclose or suggest wherein said speculative partial intersymbol interference estimates or said combination of partial intersymbol interference estimates equal a channel coefficient multiplied by a data symbol value, as required by claim 2.

20 In the Response to Arguments section, at page 6, the Examiner cites col. 12, lines 37-44 of Mui, which teaches the precomputaton of tap weights, and *not* the precomputation of speculative partial intersymbol interference estimate. In fact, a precomputed speculative partial intersymbol interference estimate is the product of a channel coefficient (i.e., a tap weight) and a data symbol value. Mui defines the template
25 $q(a,b)$ as the desired output of the partial equalizer. *See*, col. 12, lines 45-61. Mui teaches that the output of the partial equalizer is substantially free of precursor ISI and contains at least some of the postcursor ISI. *See*, col. 12, lines 14-21. Therefore, the template $q(a,b)$ contains all ISI remaining after the partial equalizer. Thus, the template $q(a,b)$ is not a speculative partial intersymbol estimate (for this it would have to be a
30 partial ISI component of the ISI remaining after the partial equalizer). Also, Mui does not

teach to precompute speculative partial ISI estimates, where the speculative partial ISI estimate is equal to a channel coefficient multiplied by a data symbol value.

Regarding claims 3 and 13, Mui (FIG. 17) does not teach that (x,y) is a decision from a corresponding state. There is no basis for this interpretation in the specification or in FIG. 17 of Mui. "Survivor symbol" is a well known term of art that refers to the symbols retained for each surviving path in the Viterbi algorithm. See, e.g., E.F. Haratsch and K. Azadet, "A 1-Gb/s Joint Equalizer and Trellis Decoder for 1000BASE-T Gigabit Ethernet," IEEE J. of Solid-State Circuits, Vol. 36, No. 3, 374 – 384 (March 2001).

Regarding claims 4 and 14, Mui (col. 33, lines 65-57) does not teach that the first or second past decision from a corresponding state includes an add-compare select decision to compute one partial intersymbol interference estimate or to select one branch metric among precomputed ones. Also, the Viterbi algorithm does not use an add-compare-select decision from a corresponding state as first or second past decision to compute one partial intersymbol interference estimate or to select one branch metric among precomputed ones .

Regarding claim 7, Mui (col. 33, lines 65-67) just references a standard Viterbi algorithm; "reduced-state sequence estimation", "decision-feedback sequence estimation", "delayed decision-feedback sequence estimation" and "parallel decision feedback decoding" are distinctly different from the Viterbi algorithm and from Mui's disclosed technique.

In the Response to Arguments section, at page 8, the Examiner asserts that FIGS. 16-18 in Mui all teach "feedback processing during decision sequence estimation, hence are all use 'decision-feedback sequence estimation.'" The Examiner's assertion is inconsistent with the well accepted usage of the terms of art "decision-feedback sequence estimation", "delayed decision feedback sequence estimation", reduced-state sequence estimation", or "parallel decision-feedback decoding." "Feedback processing during decision sequence estimation" is not sufficient for the process to be considered "decision-feedback sequence estimation", "delayed decision feedback sequence estimation", "reduced-state sequence estimation", or "parallel decision-feedback decoding."

All of the pending claims, i.e., claims 1-18, 37, and 38, are in condition for allowance and such favorable action is earnestly solicited.

If any outstanding issues remain, or if the Examiner has any further suggestions for expediting allowance of this application, the Examiner is invited to
5 contact the undersigned at the telephone number indicated below.

The Examiner's attention to this matter is appreciated.

Respectfully submitted,



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